



# Intended Outcomes and Suggested Projects

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- Web Development:

- Outcomes:

- To understand the concept of web development, how to build a web application and how to add the suitable functions to it to offer good services to many users: Websites are made of front end (client ,browser) and back end (server) that 's connected to the database.
    - To have a clear vision about web development as a whole.
    - Can identify these terms :  
(URL, Web App, HTTP (request/response), cookies, authentication, browser, server, back-end, front-end,HTML, CSS, JavaScript, jquery , bootstrap, Angularjs, node.js, Express, mongodb).
    - To understand the Full-Stack development, and clearly know what is (front-end/client-side || back-end/server-side).
    - To have a good knowledge about (client-side) tools and programming language like (HTML, CSS, JavaScript/jquery) and what goes where.
    - To learn how to set up a simple server and makes request to that server (send and receive data).
    - To have a good knowledge about (server-side) tools and languages like (PHP, NodeJS, Ruby on rails, .net) and for database (SQL Server, MySQL, mongodb(no sql)).

- To know about some advanced terms like (responsive-design, UX, UI, Prototyping, security, caching, server traffic/load, sharing/expanding).
- To see web development as a big picture and have a good understanding about it's parts.
- To learn how to generate/produce a working prototype with the minimum functionality that support his idea.
- To know about Content Management systems like:(Word Press, Joomla).
- To understand of basic ideas such like authentication, cookies, sessions, local storage, session storage, browser cache.
- Suggested Projects:
  - *E-Commerce Website:* The project comprises a page for visitors that shows items from a database in a good usable UI, and a control panel to manage these items. The developer will have to create a page that is shown to visitors and a control panel for the site administrator to add and remove data from a database. The website connects to the database and shows the items. The control panel will need authentication and offer functionality of adding, remove, edit and save items in a database.
  - *E-Learning Website:* A website for college/school students in which you can find videos and articles for some (college/school) subject, for example imagine a group student that can share their lectures, and youtube videos, for a specific subject. A student (user) can post an answer or ask a question. Answers will be sorted according to some algorithm.

- *Governmental Aid Services Website:* A website which provides steps you need to overcome a problem you faced in any governmental institution, imagine you need to get your driving license so you can access this site and search for the demanded papers, or learn some hacks that save your time. this small concept can be generalized to any similar situation like: ( passport, military service, id, etc).
  - *Part-time Activity Website:* A website for your "hand-made" or part-time activity, a lot of people use their hobbies as a part time job but the problem is how can they market themselves. In other words, imagine a person who made a custom cup-cakes, and another person who needs some one that can make them, instead of asking a friend or searching online, he/she simply can open this site and search for cup-cake maker (and see work produced by this person, see the rating and review of his cup-cakes) and make a deal with him/her.
- Programmable Logic Controllers (PLC):
    - Outcomes:
      - To learn Classic Control to have:
        - Outcomes like:
          - Main concepts.
          - Implementation of basic classic control applications.
        - Some terms and concepts like:
          - Types of control.
          - Switches (connections and types).
          - Sensors (connections and types).
          - Relays .
          - AC Motors and DC Motors.
          - Power circuit and control circuit (Relay logic).

- Timers: Time to run and time of running.
- Sequential Control.
- To learn PLC to have:
  - Outcomes like:
    - The main concept.
    - Implementing the same basic applications using PLC.
    - Being able to use simulation software program.
    - Discover any error or problem in any system.
    - Design and create a system controlled by PLC.
  - Some terms and concepts like:
    - PLC connections and types.
    - Ladder diagram.
    - Markers.
    - Timers.
    - Counters.
- To keep in mind some notes:
  - PLC is a major field and being in a single track makes it a very challenging one because its projects require high cost either in sources of learning or materials.
  - Outcomes can be great even for a medium projects because it concentrates only on PLC and it has its direct practice in industry.
  - The major issue is the cost and the availability of resources.
- Suggested Projects:
  - *Smart Garage*: It opens and closes its doors automatically when a car wants to enter or exit and also counts cars inside the garage, when the garage is full it will not allow cars to enter.
  - *Color Mixer Machine*: It gives us three different mixed colors.

- *Solar Tracking System:* In this project, PLC is used to control the movement of the solar cells in farms that require motors of high rating and thus PLC is the choice.
  - *Production Line Control System:* In this project, for a specific product, materials run through a process over various machines to finally get the product. PLC units are used to control such process ( think of a product or get a process from any factory, Cola Cans for example). its time depends on the size of the process.
  - *Smart Elevator:* It is an elevator which can take action to go for the nearest call. The control of speed is done according to the weight and more existed parameters using PLC units.
- Networks:
    - Outcomes:
      - To understand the concept of network, how to establish it and how to modify its performance.
      - To understand the meaning of Networks and when we can add it to our system.
      - To know how to establish it depending on the application (it could be LAN or WAN) and how to choose the best type of connection (wired or wireless).
      - To understand how to control it to give the best performance of the system: (studying the network traffic, delay and how to make load balance).

- Suggested Projects:

- Simple IoT project: It is a mobile application that acts as an alarm connected with the coffee machine.

- Aerospace:

- Outcomes:

- To know about basics of Aerospace Science and how it is based on the other sciences such as physics, fluid mechanics and thermodynamics.
- To know that Aerospace Engineering is divided into two major and overlapping branches: Aeronautical Engineering and Astronautical Engineering. The former deals with crafts that stay within Earth's atmosphere, and the latter with crafts that operate outside it. So, the participant has to choose one of them to focus on.
- To learn the lift theory, forces on the aircraft, thrust, CG determination, aircraft main parts, the control surfaces and its effect on craft motion.
- To take introduction in design, aerodynamics, propulsion, rockets, RC planes and Rotorcrafts, so, the participant can choose wisely what's suitable for him.
- Based on the project, the participant will study deeply how to design it. Let's say he/she has chosen to design a UAV so he/she will know the equations that serve him/her to design this UAV: (Sizing , Aerodynamics Calculations, Stability

Calculations, Performance Calculations, thrust calculations and so on).

- To learn a CAD Program such as SolidWorks.

- Suggested Projects:

- *Drones:*
  - Fixed Wing RC Planes.
  - RC copters such as quadcopters.
- *Prototype for a space rocket.*
- *Advertising Airships:* Airships that are powered, steerable aircrafts that they are inflated with a gas that is lighter than air.
- *Hovercraft:* It is a craft capable of traveling over land, water, mud, ice, and other surfaces.

- Automotive Engineering:

- Outcomes:

- To know the basics of the Automotive Science, Like: (Engine ( It's the main part ), Vehicle Dynamics (Brakes, Suspension, Steering), Chassis, and some of Aerodynamics Basics).
- To learn some of mechanisms of motion.

- Suggested Projects:

- *Small carting:* It is a small and basic car used for playing in tracks of children.
- *A model of an engine* from a heavy plastic material.
- Civil Engineering:
  - Outcomes:
    - To understand how to resist the external forces with the internal forces of the material used in the construction process and to design this structure to be stable and safe because, Civil Engineering is the field of stability. All structures however the usage they are designed for, has to resist the external forces affecting on them to be stable, safe and comfortable to use.
    - To understand the load transfer from the structure passing by its components to its foundation and eventually to the ground safely. And this contributes to the later point also.
    - To understand the importance of cost and serviceability. As a civil/structural engineer, you have to study the cost of the project so you will be able to determine the most appropriate design concept and the material used. And the structure you designed and executed must serve the goal it designed for comfortably in the architecture design.
  - Suggested Projects:
    - *Infrastructures Projects* like water stations, Dams, Sewage. and so on

- Game Development:

- Outcomes:

- To understand the meaning of programmer, designer and artist as a team requires the existence of the three roles.
    - To learn the usage of game engines (Unity 3D is recommended).
    - To know about Game Development life cycle.
    - To know about game architecture (with respect to the used game engine) : game hierarchy, game object components, assets, game input, ....etc.
    - To know about:
      - Game Design : target audience and target platform: (console, web, PC, mobile, .. etc).
      - Game Genres: (Platformer, RPG, FPS, ...etc), game theme(action, adventure, ...etc).
      - MDA framework (Mechanics Dynamics Aesthetics), simple game design document, game prototype (could be using scratch or any simple game engine).
      - Game Programming (Object oriented programming).
      - Game Math and Physics (2D/3D).
      - Graphic Design (characters, background, game elements, UI).

- Animation & Effects.
- AI (basic - moderate - advanced) depends on the game.
- To make game prototype (at least one fully functioning level of the game ).
- Suggested Projects:
  - *Classic Games*: The link is so helpful and has lists of games to start with:  
<http://gamedev.stackexchange.com/questions/854/what-are-good-games-to-earn-your-wings-with>
- Embedded Systems:
  - Outcomes:
    - To understand the concepts and topics of:
      - Signals - Analog vs.Digital.
      - What is meant by Embedded Systems and Microcontrollers?
      - Memory Types and Usage (RAM, ROM, EEPROM, ...etc).
      - I/O.
      - PWM.
      - ADC.
      - Analog Comparator.
      - Timers.
      - Interrupts.
      - Communication Protocols like: SPI, UART, and I2C.
      - Introduction to Embedded C.
    - To increase skills of Problem Solving.

- Suggested Projects:

- *Metal Detector Robot*: It is a robot that senses the existence of metals.
- *Fingerprint Based Electronic Voting Machine*: It is a machine that applies the process of voting through Fingerprint check.
- *Line Follower Robot*: It is a robot which is simple in its mechanical design and needs work with Micrococontrollers and sensors. It follows a predefined line for a specific purpose.
- *Maze Solving Robot*: It is a robot which is simple in its mechanical design and needs to work with Micrococontrollers and sensors. It applies some specific algorithms to solve a maze (constructed by walls) at the least possible time.
- *A calculator which helps blinds through voice commands*: It is a calculator which makes use of different sound modules to have voice commands from the user in order to respond - with the result of a mathematical calculation - through sound also.
- *Blind-Aid tool*: It is a tool which helps the blind to be guided in order to avoid surrounding obstacles using sound commands.

- Artificial Intelligence:

- Outcomes:

- To know what is meant by Machine Learning.
- To know what is meant by regression and classification.

- To know what is meant by search algorithms.
- To know what is meant by Neural Networks.
- To know what is meant by Deep Learning.
- To know what is meant by Computer Vision.
- After that, the participant must decide what he/she would use in his/her project then to go in deep with the technique he/she has chosen.
- Suggested Projects:
  - *Personal Assistant for the PC*: It is an assistant software which working on a PC machine which receive its order through voice commands.
  - *Specific Object Recognition Machine*: It is a machine which uses camera to recognize a specific object (the camera is connected to a computer(PC/Raspberry PI ...etc )).
  - *Car plate Reading machine*: It is a machine which uses camera to read what is written on car plates (the camera is connected to a computer(PC/Raspberry PI ...etc )).